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TRADITIONAL TENURE SYSTEMS REGULATING FOREST PRODUCT EXTRACTION AND USE BY THE ANTANOSY OF MADAGASCAR

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ABSTRACT.—The Antanosy of southeastern Madagascar rely on forest products to meet their daily subsistence needs; the forest itself provides land for agricultural expansion (Lyon 1999). An informal local land tenure system regulates the collection and ownership of forest products. Local forest management is critical to the management and conservation of the forest. Although the particular resource concerned determines the restrictions placed on land use, systems exist to regulate most aspects of forest use. This research investigated particular aspects of forest use and the local use of a *dina* (or community-based contract). The Antanosy use dinas to clarify and define individual and community responsibilities including particular aspects of land tenure. Such agreements exist to give the community control over their own use of forest products such as wood harvested for construction purposes, uncultivated fruit, and water distribution for rice paddy irrigation. This paper explains the Antanosy tenure system for forest use and the implications for community-based conservation projects.

Key words: land tenure, *dina,* Madagascar, Antanosy, community.

RESUMEN.—Los Antanosi del sudeste de Madagascar dependen de los productos forestales para cubrir sus necesidades cotidianas de subsistencia; el bosque además proporciona terreno para la expansión agrícola (Lyon 1999). Un sistema informal local de uso del territorio regula la recolección y propiedad de los productos forestales. El manejo forestal local es crítico para la gestión y conservación del bosque. Aunque cada producto forestal en particular determina las restricciones impuestas al uso del terreno, existen sistemas de regulación para la mayoría de los aspectos del uso del bosque. Este estudio investiga aspectos particulares del manejo del bosque y el uso local de una *dina* (o contrato basado en la comunidad). Los Antanosi utilizan las dinas para definir y clarificar responsabilidades individuales y comunitarias y algunos aspectos del uso del terreno. Este tipo de acuerdos existen para conferir a la comunidad un control sobre su propia explotación de los productos forestales tales como madera talada para construcción, frutos silvestres, y distribución del agua para la irrigación de campos de arroz inundados. Este artículo explica el sistema de tenencia de los Antanosi para la explotación del bosque y sus implicaciones para proyectos de conservación basados en la comunidad.

RÉSUMÉ.—Les Antanosy du Sud Est de Madagascar tirent la plus grande partie

de leur subsistance quotidienne de la forêt qui fournit également la terre pour l'expansion agricole (Lyon 1999). Un régime foncier local officieux régit la cueillette et la propriété des produits de la forêt. La gestion forestière locale est essentielle à l'aménagement et à la conservation de la forêt. Bien que les ressources particulières déterminent les restrictions imposées sur l'utilisation des terres, des systèmes en place régissent la majorité des aspects de l'exploitation de la forêt. Ce projet a étudié des aspects particuliers de l'exploitation de la forêt et l'utilisation locale d'une *dina* (ou contrat communautaire). Les Antanosy ont recours aux dinas pour clarifier et définir les responsabilités individuelles et communautaires et certains aspects du régime foncier. De tels accords permettent à la communauté de contrôler leur propre exploitation des produits forestiers, comme la coupure des arbres pour le bois de construction, la cueillette des fruits sauvages, et la distribution de l'eau pour l'irrigation du riz paddy. Cet article explique le système foncier des Antanosy pour l'exploitation de la forêt et ses conséquences pour les projets communitaires de conservation.

INTRODUCTION

In many traditional societies, community-based, informal land tenure[1] defines social relationships between people and their property at a level of land management that often overrides government control of the area (Lynch and Alcorn 1994). Indigenous cultures often establish tenure systems to regulate natural resource use and prevent overuse of a resource by any one person, and satisfy human needs (Glaesl 2000). Tenure can determine who is allowed to use a particular resource and the circumstances surrounding that use. It is through these relationships that land-use rules are developed (Lynch and Alcorn 1994).

Understanding relationships among members of an indigenous culture is crucial in the design of successful conservation or development projects. Experience reveals that many project planners fail to consider this. Conservation and development projects in many "third world" countries are often based on community management systems. Integrated conservation and development projects (ICDP) in the early 1990s are examples of projects that were designed for first world conditions. Intended to unite a village or set of villages at a community level, these projects failed in areas where strong kinship ties and conflicting local land tenure systems existed. The point here is not so much that ICDP projects should have been managed at a family level, but that a thorough investigation of the region's land tenure systems should have been part of the project design.

This paper will discuss the Antanosy's land tenure system in terms of how it is used to manage the collection and ownership of forest products. Given this indigenously designed and managed system for regulating forest products, we argue that only by designing a conservation system around a local management plan will forest resource conservation plans be successful.

METHODS

Study Area.—The eastern region of Madagascar covers just under half the island, extending westwards from the east coast to cover the central highlands. This area is thought to originally have been completely forested, but much of the forest has

now been replaced by a mosaic of cultivation and secondary rain forest (Harcourt and Thornback 1990). Field research was conducted from 1995–1998 in the Tsitongambarika classified forest, Parcel I (24°50′ S, 46°53′ E), a government established mixed secondary and dense rain forest that is part of the coastal strip of southeastern Madagascar (Direction des Eaux et Forêts and Conservation International 1993). The forest is actually divided into two connected sections, the more southern Parcel I and Parcel II. Parcel I was created in 1965 with 9,530 ha reserved to act as a buffer for the larger and more unique area of the now named Andohahela National Park. In 1970, the Malagasy Ministry of the Environment enlarged the reserve by establishing Parcel II which included another 38,930 ha to the north, as they felt that Parcel I was not an adequate buffer for the large and heavily visited forests of Andohahela (Direction des Eaux et Forêts and Conservation International 1993). The region where this research was conducted was under local jurisdiction by the people belonging to the Fokontany of Tamboro. (A *fokontany* is the lowest ranking administrative level recognized by the Malagasy government and is usually made up of several villages or approximately 1,000 people.) The Fokontany of Tamboro consists of seven villages that rely almost solely upon the Tsitongambarika for their forest product needs. Villages are between one and four kilometers from one another and three to five kilometers from the forested region of Tsitongambarika.

The Antanosy constitute the majority of the inhabitants of the southeastern region of Madagascar, which encompasses the Tsitongambarika Classified Forest. Today, like other ethnic groups of the south, they are thought to be among the country's poorest people, living on what they find in the forest or eking out a meager existence with irrigated paddy rice (*Oryza sativa* L.) (Figure 1) and cattle (*Bos indicus*).

The ancestors of the Antanosy migrated from northern Madagascar to the area approximately 150–200 years ago (Mittermeier et al. 1994). The modern Antanosy are mixed with others who passed through the area. The first were from the Zafiraminia Dynasty who arrived in northern Madagascar from the Persian Gulf or Indian subcontinent (Goodman and Patterson 1997) and crossed the island to the Antanosy region. The people of the dynasty declared themselves princes and kings upon their arrival and came with advanced innovations. Later the French gained a foothold in Madagascar during their voyages to the East Indies, as did the Portuguese, who used the area as a stopover en route to India. The Merina people of the high plateau of Madagascar came from a third direction and stayed in the Antanosy region for several years during their nineteenth-century expansion period (Goodman and Patterson 1997).

The region encompassed by the Fokontany of Tamboro is approximately 4 km from east to west and 2 km from north to south. The seven villages that make up the Fokontany of Tamboro are accessible only by footpath. Each village is approximately 2–3 km from one edge of the protected forest. Although Tamboro once had a dirt road running through it that could be accessed by vehicle, the road has fallen into disrepair and is no longer used. Today a vehicle-accessible dirt road exists to the west of Tamboro. Most villagers use this road when relying on public transport or for transport of their agricultural products to the regional market of Fort Dauphin.

FIGURE 1.—Irrigated paddy rice near the Fokontany of Tamboro, Madagascar. Photograph by Linda Lyon.

Population Census.—Prior to the onset of fieldwork a meeting was held with village leaders to acquire permission to conduct interviews. It was explained to them that the study was to help the first author complete her academic degree and part of her service as a Peace Corps Volunteer in Tamboro. Also, since the first author had lived in Tamboro for approximately eight months as a Peace Corps volunteer before beginning the survey, villagers knew her and most had accepted her into their homes. She had become a friend to many village women through an earlier

gardening cooperative she helped them organize. The second author was introduced to the Tamboro community before the first phase of the study to aid in research design. The second author was essential for the data analysis and the writing of the final manuscript.

This study began with a census of all villages in Tamboro to define the sample frame for subsequent data collection. A total of 304 households were found within Tamboro in August, 1995. An acceptable sample size was calculated from the total number of households in Tamboro using the formula described by Krejcie and Morgan (1970), and 170 interviews were conducted.

The household (also referred to as a family in this study) is based on paternal kin relationships of marriage, relatives sharing the same house or sharing common food preparation or consumption (Durbin 1990). The household usually remains economically independent from a larger family group yet share in the larger family's agricultural production. This larger family group often makes up one hamlet and several hamlets are found within each village.

Interviews.—Interview questions were open-ended, allowing informants an opportunity to develop their responses into a conversation. The questionnaire evolved throughout the project, as notes from interviews were transcribed and new themes or ideas developed. New questions were periodically added as topics were identified, and other questions were removed from the questionnaire when they generated a uniform response.

Interviews were conducted from September through mid-November, 1995. Interview times were varied throughout the week and the questions asked did not pertain solely to the current season. Interviews varied in length from forty-five minutes to two hours depending on the detail of the responses. Interview participants consisted of anyone over the age of fifteen who was part of the household unit and willing to respond to questions during the time of the interview. No one declined to be interviewed. Although most interviews took place in villagers' homes, separate interviews with women were sometimes arranged at a time or place less subject to domination or interruptions by men. Other interviews included key informants such as village elders, traditional healers, and schoolteachers. These informants were helpful in clarifying villagers' responses to particular questions and they usually had insightful viewpoints due in part to their longevity in the region and participation in village affairs.

Three years of participant observation in Tamboro provided additional data and clarified information generated in interviews. Observations of villagers' activities took place throughout the study, during and after interviews. Throughout this time, the first author participated in many activities, including planting and harvesting rice and manioc, collecting firewood, and gathering wild foods, as well as the social activities within Tamboro. Her inclusion in day-to-day activities gave her insight into local uses of natural resources and agricultural production that may not have been gained through interviews alone.

Coding and Analyzing Data.—Natural resource use by villagers was not quantified. Such data would have been relevant to our objectives but were beyond the scope of the project. Instead this issue was defined by scarcity relative to the previous 10 years and to current needs. Interview results were organized by household,

date of interview, and gender of the interviewee. No other demographic information about the interviewees was collected. Information that was not recorded during interviews was added to field notes shortly afterward. Grounded Theory (Glaser 1978), a type of qualitative analysis, was used to analyze the data collected from the interviews. The grounding of a theory is achieved when questions are rephrased during an interview and responses are compared with responses from other interviews until there is no doubt about the accuracy of the theory created by the responses. At this point responses are then saturated as described by Glaser and Strauss (1967) and Glaser (1978). Categories of data are then created and analyzed to explore relationships.

RESULTS

Dinas and the Antanosy Land Tenure System.—In Madagascar, all villagers living in a fokontany are under the jurisdiction of a local government. Communities create and enforce *dinas*, which are written rules that govern how people live within the community. Dinas codify local traditions or establish formal rules for new circumstances, commonly concerning social interactions, collective actions such as school repairs, and certain uses of land. It is believed by Madagascar historians that the dina's land tenure provisions are similar to the traditional tenure systems established by the Antanosy before French colonization when villagers were forced to accept foreign ideas of land distribution and use. A dina is usually written by the president of a fokontany, and approved by the community through the votes of lineage heads.

In the study area, the Malagasy Forest Service had established general boundaries for national parks, protected areas, and classified forests. Within these systems villagers could exert further control on the use of their local natural resources. In 1995, a dina limiting the area of forest that could be used for forest product extraction, agricultural fields and grazing was created by the Fokontany of Tamboro. This dina was created with input from local Forest Service officials to aid the villagers in making ecologically sound decisions about forest use. The Forest Service assisted as the need to protect these watersheds is consistent with their mission to conserve Madagascar's remaining forests.

Land is owned by family groups who are descendants of the original inhabitants of the region of Tamboro. Previously family members simply chose where they wanted to farm and claimed the land by ***miasa-tany*** (turning the soil). Currently, most of the arable land is under ownership by family groups, and people new to the region must pay in Malagasy francs for the land or be given it as a gift by one of the older family groups.

Any person who attempts to occupy another person's land is in violation of these land tenure rules and must pay a cash fine to the person, fokontany, or National Malagasy Forest Service. The same penalties apply to people who try to farm areas of the forest designated by the dina as non-cultivated. Although farmers are fined and must relinquish the land, the forest is not necessarily protected, because burning has most likely already occurred by the time the community becomes aware of the violation. So although violators have to atone monetarily for their errors, in reality it is all the users of the watershed who suffer.

While a dina may include rules concerning some natural resources, it does not govern all of them or all their uses (Durbin 1990). In certain situations for example, villagers make their own decisions about natural resource management, including decisions such as how and when to plant what their fields. These less formal land use rules play an important role in management of the forest near Tamboro, including organization of agricultural fields and water rights. They are unwritten, communicated verbally, and enforced within the community with no formal outside influence. Rules are enforced through community meetings where violators are compelled to pay in Malagasy francs, rice, or cattle to compensate for their violation.

Normally, individuals or family groups own ditches or canals between rice paddies that are fed by a river that was channeled during the colonial period. The canals are built and maintained by the people whose rice paddies they border. If one person violates another's agricultural or water rights, they must pay a fine to the person or family directly affected. If the violation affects the community's resources, for example the building of an unauthorized canal, then the fine is paid in cash to the community as a whole and used for projects such as repairing the school.

The Relationship between Proximity and Tenure Rights.—People in all seven villages of the Fokontany make use of the forest on at least a weekly, if not daily, basis to collect forest products either for individual family use or for sale at the local market. The proximity of a hamlet to the forest influences the frequency with which the forest is visited. Most villagers living within half a kilometer of the forest visit it twice a day. By comparison, villagers living two kilometers from the forest might visit it every two days. Both men and women feel that it is not safe for women to go into the forest to collect medicinal plants or do any type of agriculture; however this restriction does not seem to involve tenure.

Proximity to the forest also plays a substantial role in the emphasis villagers place upon their relationship to the forest and the use of its products. People living closer to the forest showed more interest in how it was managed than villagers located farther from the forest. An example can be seen during the creation of the previously mentioned dina, wherein people from the three villages closest to the forest were more involved than people from other villages.

Neither formal nor informal land rights restrict housing sites. These sites appear to be fairly flexible; consistent with the patrilocality of the society, most sons build their own house within the same hamlet as their parents.

Forest Products Important to Tamboro.— Five use categories evolved from interviews where people were asked to list the forest products that they relied on to meet their everyday survival requirements: firewood, construction materials, tools, medicinal plants, and wild foods. Within these categories the diversity of plant species used by villagers varied. For example, of the 355 species mentioned by villagers, 37% are used for medicinal purposes, whereas only 3% of this total are used for ceremonial purposes (Figure 2). These data indicate that there may be enough diversity of medicinal plant species so that no one species is over-harvested. The low number of plant species available for ceremonial purposes may be insufficient to meet the needs of the entire local populace, and may put stress on those plant populations. Further research, however, on the rate of use and

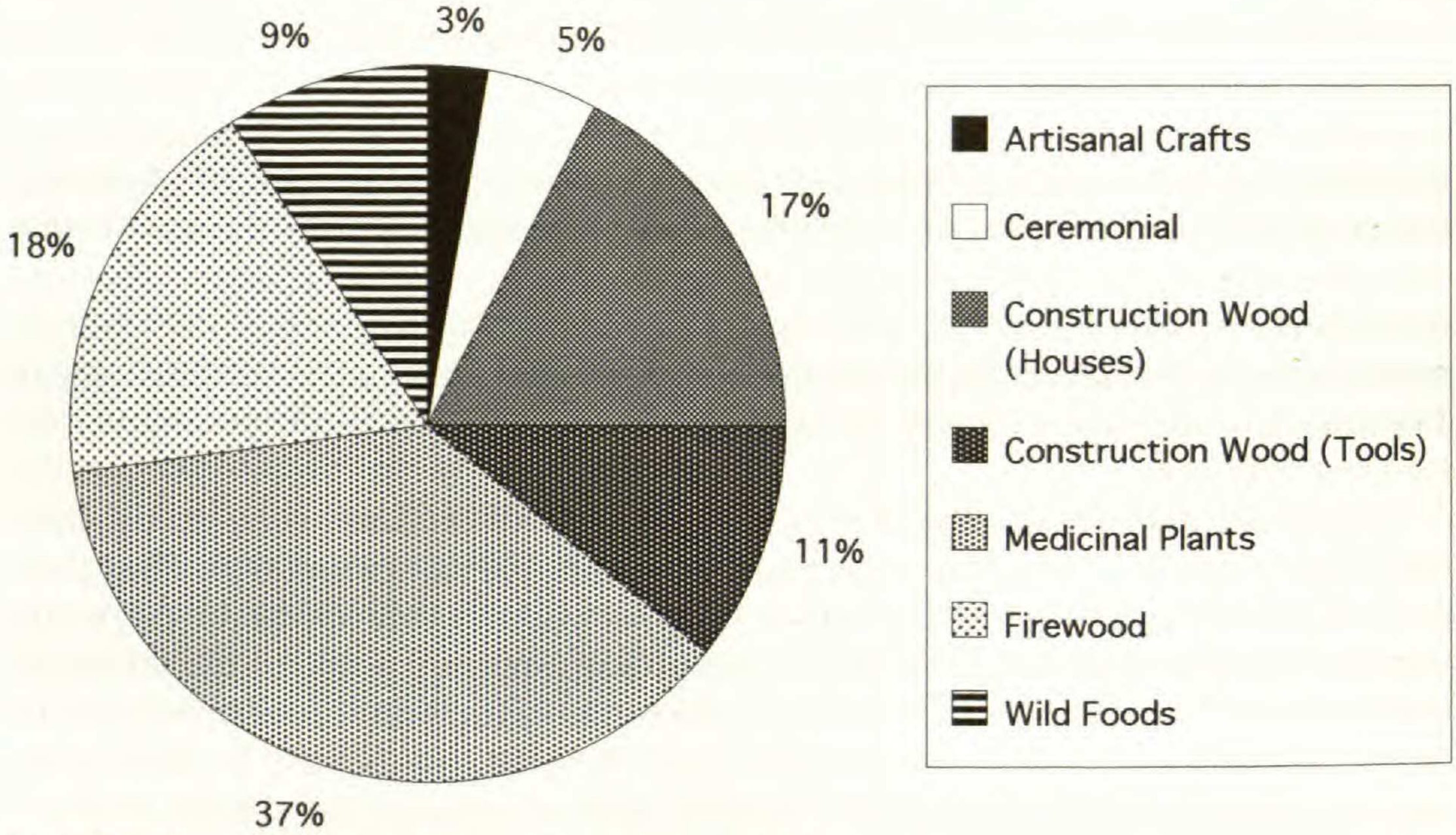

FIGURE 2.—Diversity of plant species used by villagers.

density of a given species would be necessary before this could be verified. Although traditional tenure and land use systems regulate forest production extraction and use, in the face of Madagascar's increasing population this system may not be adequate to protect particular species from being over-harvested.

Firewood. Men collect firewood near where they live. Thus, men from the four villages closest to the forest collect most of their firewood there, while men from the other villages collect wood alongside abandoned rice paddies. Villagers explained that this is a matter of convenience, but hamlet location itself is strongly influenced by tenure and kinship. People do not search for particular woods; rather fuel choice depends on what grows in the collection area. Within that constraint, ***voasary*** (*Citrus depressa* Bory.), ***kininy*** (*Eucalyptus citrodera* Hook.) and ***vontaky*** (*Strycnos spinosa* Lam.) are the preferred firewood species due to their hot flame and long burning time, but many other tree species are also used. Even though trees or branches are sometimes cut green, the fact that a broad range of species is acceptable for firewood might prevent a fuel shortage. Villagers explained that no species used for firewood is harder to find now than in the past, which suggests that there has not been serious pressure on the forest due to demands for firewood.

Construction materials. Villagers prefer cement houses due to their resistance to the elements, but more often have wood and ***ravenala*** (*Ravenala madagascariensis* Adans.) thatch houses. We have seen houses made of wattle and daub; although they are inexpensive to build, they are less common because they are more difficult to maintain.

Almost all construction materials are collected by young men from the forest and land tenure does not appear to influence collection except in areas where government restrictions within the classified forest apply. Men from all villages make use of all areas of the forest to find building materials. Planks for doors and win-

dows are made from large, durable wood species such as ***grevillean*** (*Grevillea banksii* R.Br.). Most people use the hardwoods ***magnary*** (*Dalbergia* sp.) or ***kininy*** for framing. Due to their strength and resistance to termites, replacement of these timbers is usually not necessary for at least 15 years. ***Ravenala*** leaves are used as a roofing thatch, and the stems are used as sheathing for the walls. Cord for the roof thatch is peeled bark or lianas of species such as ***taikafotsy*** (*Grewia* sp.).

Of all the forest products extracted from the watershed, only those species used for construction wood are reported to be harder to find than they were 10 years ago. These results indicate a degree of scarcity because of local pressure for construction wood. People feel that large ***ravenala*** trees are still available in the forest, but had become scarcer. Consequently, the availability of cash had become a limiting factor in construction, as most people had to buy the leaves and stems of ***ravenala*** at the local market rather than collect their own supply. ***Ravenala*** was sold at the market by men from other fokontanies around the classified forest.

Tools. As with construction materials, there do not appear to be any restrictions on the collection of wood for tools based on land ownership. Men of all ages collect wood as necessary to keep themselves supplied with adequate tools for working in their fields. Several varieties of wood are used to create handles for the tools used in farming and building. ***Voandelaky*** (*Melia azedarach* L.) is the favorite species of wood for axes, shovels and other tools requiring a very strong handle.

Medicinal plants. Generally middle-aged to older men and women use medicinal plants extensively (Randrianarisoa 1996). Younger men and women are not as familiar as their elders with even the most basic plant remedies. Plants can normally be found growing wild near villages or in the forest. No villagers reported planting specifically for medicinal uses. Most people know of at least a few plant remedies for common ailments such as diarrhea, fever, eye infections and burns, and rely on traditional healers or go to the hospital when faced with a more serious or unusual illness.

Traditional healers know the most remedies made with plants, but their occupation does not give them more exclusive collection rights. Members of particular families were aware of more remedies than other families, but collection rights appeared to be fairly equal. Men do more collection of forest plants, such as *Asplenium* sp., but overall women do more collection and preparation of medicinal plants.

Traditional healers and villagers reported no decrease in medicinal plant availability or fear of a future decline. This stability could be due in part to the fact that most remedies require only parts of a plant so medicinal plants survive harvesting. Stability could also be due to substitution. Most illnesses can be treated with a variety of plants, and Western medicines are also used. Some western medicines are preferred for particular illnesses as most people feel Western medicine is more reliable than plant remedies. Yet western medicine is not used more frequently than traditional medicine, perhaps because of the cost. Further research is currently underway to determine the potential for using medicinal plants as an indicator for forest product scarcity.

Wild foods. Informal land tenure rules affect the harvesting of fruit. Normally, villagers only plant trees on their own land, and ownership of fruit trees is given to the owner of the land. This is, however, dependent on the type of tree. Valuable native and cultivated fruit trees—litchi (*Litchi sinensis* Radlk.), banana (*Musa* sp.)

(Figure 3), and coffee (*Coffea* sp.)—usually have strict access rights and only the family owning the land under the tree is allowed to harvest the fruit. The fruit of the litchi trees is of such high value that the family may have a guardian watch over them during harvest season. There were no banana or litchi trees growing near the villages that did not belong to a particular family. Occasional theft occurs, but is fairly difficult to accomplish without the thief being seen. Violators usually have to pay the owners of the tree with money or equivalent compensation. Other valuable fruit trees cultivated around the village include; coconut (*Cocos nucifera* L.), papaya (*Carica papaya* L.), ***corossolier*** (*Annona muricata* L.), and avocado (*Persea americana* Mill.). Although these trees are not as valuable as litchi, banana and coffee, they are still economically important to lower income families who sell the fruit to supplement their income.

Less valuable fruit trees, including oranges (*Citrus sinensis* Osbeck), lemons (*Citrus limon* L.Burm), mandarins (*Citrus reticulata* Blanco), guava (*Psidium* sp.), mangoes (*Mangifera indica* L.), tamarind (*Tamarindus indica* L.), and jack fruit (*Artocarpus integrifolia* L.f.), are cultivated and can be found growing wild in or around villages. Their market value is lower due to their relative abundance. Most of these species, although introduced, are considered common property resources even if they are located on a particular family's land. Often their ownership history is no longer known or they may have propagated naturally.

DISCUSSION

The traditional land tenure system plays a role in the use of most forest resources by the Antanosy at this time. Although the rigidity of land tenure seems to depend on the resource (i.e., water, fruit, land), land tenure controls all aspects of forest use. Dinas are used by the Antanosy to manage particular aspects of forest resource use within the constraints of the local tenure system. The 1995 dina was designed to conserve a particular area of the watershed to protect the tributaries that feed a larger water source. In order to protect the river that provides irrigation for most farmers, all Tamboro villagers agreed to, and thus are bound to obey, a dina that restricted all citizens' use of the forested land near the tributaries. This arrangement demonstrates that it is possible for the Antanosy to collaborate and maintain community level management decisions pertaining to land tenure.

Often community-based conservation projects designed by researchers and development agents fail to incorporate the traditional tenure systems practiced by local people into conservation efforts. Such projects frequently fall short of identifying local people's needs and conservation issues (Stevens 1997). This is because these projects often take into account only formal or government systems of land use, which might conflict with traditional management systems. Exploring communities' existing land use systems can help identify critical issues and reveal how local tenure systems can support conservation goals.

Given the rapid rate of environmental destruction in Madagascar, urgent attention is being given to conserving the country's remaining natural resources. The information developed in this study suggests an important key to curtailing Madagascar's loss of the rain forest. Local, traditional systems of land tenure and resource allocation may exist that can be an obstacle or an asset to development

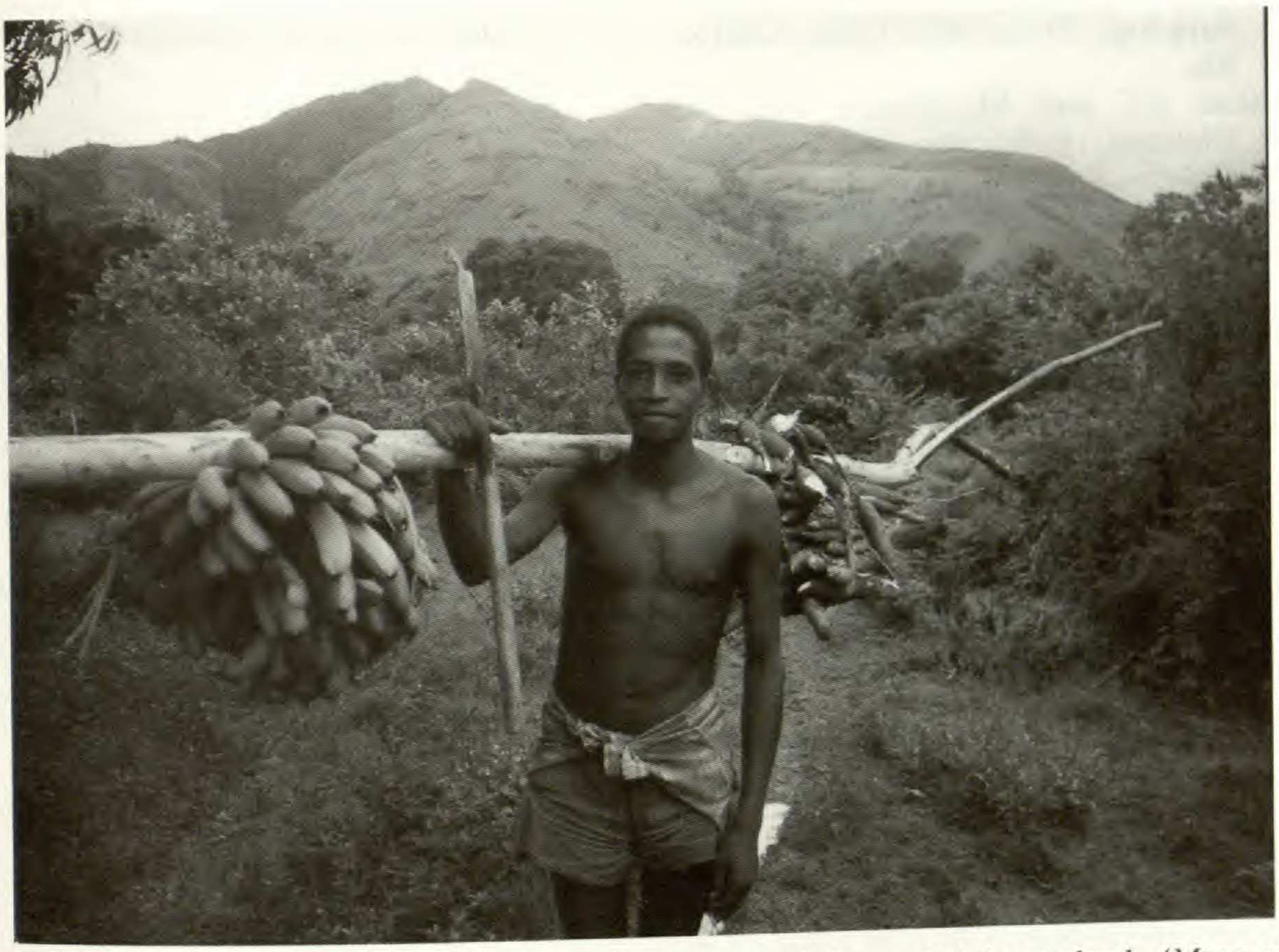

FIGURE 3.—Man from the Fokontany of Tamboro with harvested forest foods (*Musa* sp. on the left and and *Manihot esculenta* on the right). Photograph by Linda Lyon.

efforts. Although this research is specific to the people of Tamboro, all those working on community-based conservation projects in Madagascar and other nations should understand, and when possible work within, functioning tenure and land use systems to enhance the long-term success of conservation projects.

NOTES

[1] Informal land tenure is defined as bundles of individual rights that determine the use and ownership of particular resources. Within the informal land tenure system a collective group of individuals or a family group may own a resource (i.e., land), but individuals not within these groups may have ownership of a part of this resource (i.e., trees on the land). It is also important to note that often informal land tenure can exist within a formal (legal) land tenure system or might override such a system depending on the stability and enforcement of the formal system.

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